Findings

Telepresence and Human Exploration

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Context

Terrestrial telepresence technologies have proven their value in the breadth of application in industry, commercial, and research endeavors – improving safety, saving lives, saving costs, improving operational efficiency, and enhancing science return.

Human space-based activities will benefit from identifying and integrating the applicable knowledge and training experience from these terrestrial endeavors.

These are substantive examples of direct reciprocal benefits between terrestrial and space-based telerobotics and the technologies necessary to enable them both.

General Findings

Telepresence . . .

. . .enables human operations in hostile, inaccessible, or limited-access environments.

. . . enables improvisation in quick response to changing conditions, expanding the range of environments in which human activity can be undertaken: challenging surfaces, pinpoint landing, operating outside human habitats.. [*combine this and the following]*

. . . reduces mission risk through improved situational awareness, being able to react to the unexpected/unplanned.

. . . offers an immediacy of interactive experience that significantly enhances STEM education at all grade levels. It offers similar experience for public outreach in participatory exploration.

Specific Findings

Extending human capabilities and insight through telepresence will be a significant capability of future human activity in space.

In particular, these mission scenarios will be enhanced:

(1) Science operations on the Moon or Mars controlled from orbit, Lagrange points, or on the surface
(2) Robots controlled from Earth (e.g., satellite servicing in GEO from Earth's surface)
(3) Assembly operations of large structures from Lagrange point (e.g., large telescopes of the 2020s and beyond)
(4) NEO/Deimos/Phobos proximity operations
(5) Service operations on board ISS or other spacecraft controlled by crew

Next Steps

Virtual environment simulators can be used for telepresence training in space.

Trade studies are of value in assessing the costs of proximity and different levels of latency between human and telerobotic assets to achieve defined mission goals.

Operations at different spatial scales . . .